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Fig. 1.

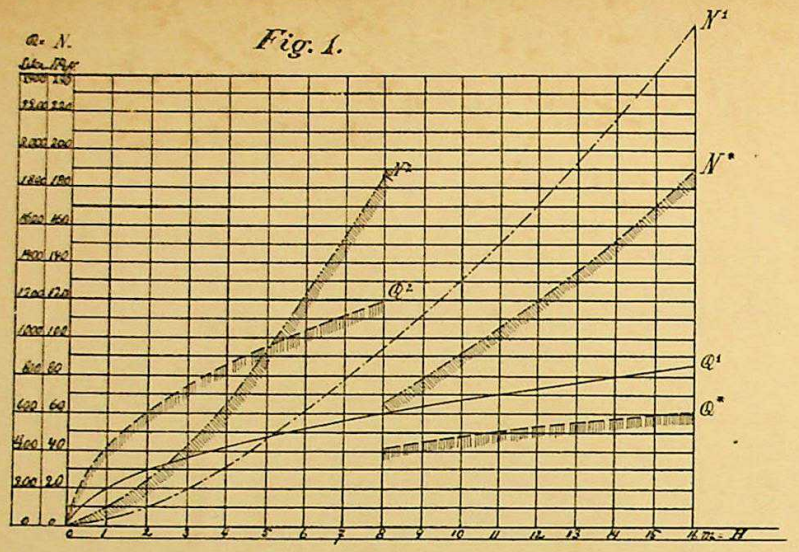


Fig. 3.

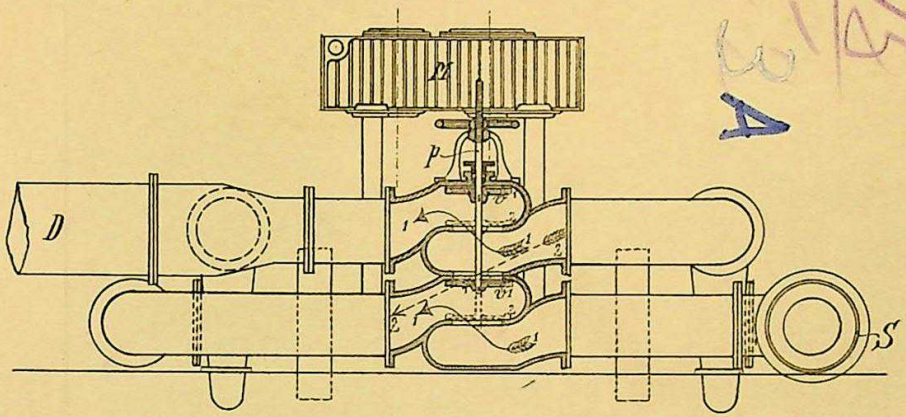


Fig. 2.

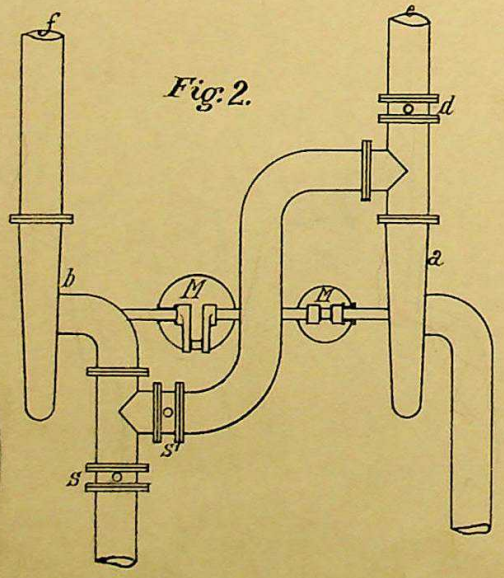
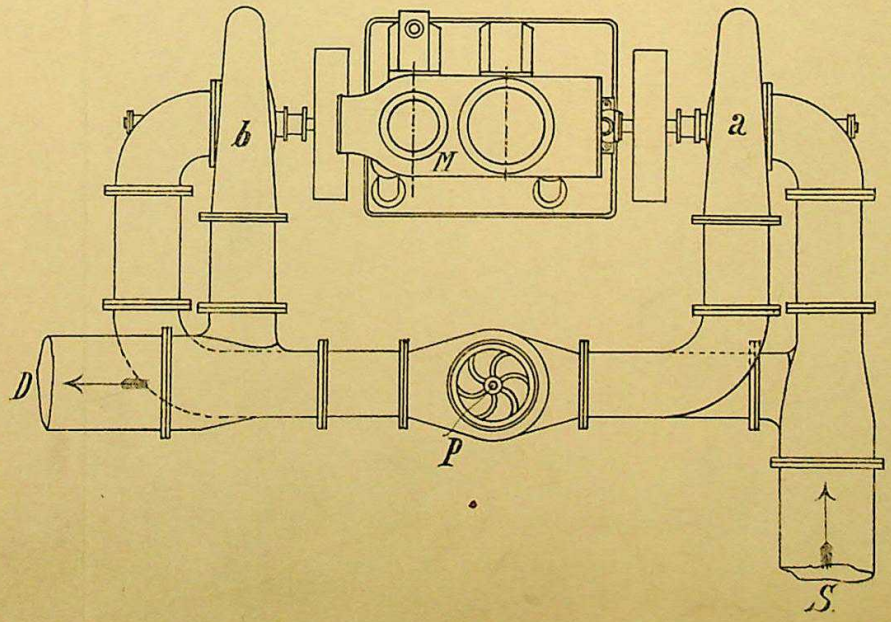


Fig. 4.



Pumps may operate either in series or in parallel.

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Zu der Patentschrift

№ 73159.

PHOTOGR. DRUCK DER REICHSDRUCKEREI.

OGRAPHS
MAR 10 1903
Sheet Cent.

E.Sz. 1 /23/'03.

ISSUED JANUARY 25,1894.

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IMPERIAL PATENT OFFICE.

S P E C I F I C A T I O N.

-No.73,159-

Ger Pat 73159
Class 103/106

CLASS 59: PUMPS.

EISENWERK (previously NAGEL & KAEMP) AKTIENGESELLSCHAFT in HAMBURG-UHLENHORST.

Device for Connecting Rotary Pumps in Parallel or Series.

Patented in the German Empire from June 2,1893.

In the practical conveyance of water, there occur a number of cases, where it is a question of removing a certain large quantity of water out of a receiver in a short time, where the level at the beginning of the pumping lies as high, as that to which it is to be pumped, but later on drops down considerably.

This case occurs, for instance, in emptying sluices, docks and like edifices, where rotary pumps, which are the ones that come the best into consideration, beginning from a height of conveyance equal to zero, have to pump to a height always increasing.

The mass of water conveyed must now in the case of rotary pumps correspond to the circumferential velocity of the rotating part and this $= \sqrt{2 g H}$, in order to raise the water to a height of H, therefore the mass of water Q, the number of rotations of the rotary part n and the height of lift H are independent of each other; also naturally the expenditure proportional to the product Q H is equal to N.

The graphic representation in Fig.1 of the drawing shows in the curve designated by Q^1 the increase of the mass of water of a rotary pump(in litres per second) in case of increase in height of lift(in meters), also in the curve N^1 the increase in consumption of power (in effective H P).

It appears from this that the motor provided must be measured to correspond with the very great rendition finally demanded of it,

although the requirements at fi rst arenot worth mentioning.

In order to make this faulty relation more favorable, the question in the first time when the height of lift is still small, to utilize the driving power at disposal advantageously by the throwing of large quantities of water, which can be attained for instance, by the simultaneous driving of several pumps. Later, on the arising of greater height of conveyance, it is of avail to diminish the quantity of water conveyed, so as to require no excessively large driving power, and this can be obtained, among other things, by connecting the pumps in series, so that one pumps the water to the other.

The graphic representation in Fig.1 gives in the portions of curves Q^2 Q^x and N^2 N^x an example, of how a pump, in the double arrangement shown can be utilized for the foregoing purpose.

At the beginning and until the height of conveyance has reached H = 8m both pumps are allowed to work in parallel and there is so obtained, in comparison with Q^1, a double quantity of water Q^2 and correspondingly also an engine output to be applied N^2 of double the amount, compared with the N^1 of the single arrangement described further above.

Now if after the height of conveyance has risen to 8m we switch the pumps in series, then the first pump conveys a mass of water to a height of H = 4m, and pumps it to the other which again raises it 4m high, so that the quantity, which corresponds to only 4m of conveying height, is actually raised to 8m. Corr spondingly the consumption of power also decreazes after the switch over, and we can now extend to second period to a height of lift H = 16m, before the power engine has to develop the same output again, that it had already at the end of the first period(see curves Q^x and N^x). That this final output of the power engine in the case of this connecting up is considerably less than it would be with the single arrangement is obvious at once on inspection of the end point of the line N of the graphic representation; besides we recognize from the lines Q^2 and N^2, as

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well as from their continuation Q^x and N^x, that the total amount of water conveyed in the arrangement mentioned falls out comparatively considerably greater. Finally after what was mentioned in the beginning there appears the further advantage, that the number of rotations has to correspond to only he half of the height of conveyance finally attained.

Instead of the double arrangement of course in case of necessity

Fig. 2 shows a schematic view of such rotary pumps in double arrangement; a is the one b the other. Into which the pressure pipe of the first is inserted a slide(valve) d, into the suction of the second a slide s, while into the pipe c connecting the pressure pipe of the first pump with the suction pipe of the second there is inserted a third slide s'.

If the said ~~water~~ slides valves s and d are opened, but s' closed, then a driving engine M N set up between the pumps works to a certain extent with two separate pumps a and b and with two separate masses of water pressed forward in the pipes e f .

But if the slides s and d are closed and s' opened, then only the pump a sucks water in, drives it through the pipe connection to the other (b) and then each one then works on half the height of conveyance.

Figs. 3 and 4 exhibit a simple form of execution of this inventive thought; two pumps a and b with a common suction pipe S, a common pressure pipe D and an intermediate pipe connection so arranged that the switching off can be accomplished by a single adjusting spindle p. On this there sit fast two valve plates v v', of which one v' at the position shown closes the middle valve seat, so that the suction pipe S feeds both pumps and the liquid follows the arrows 1,1; parallel mounting of the two pumps. But if we displace the valve plate into the dotted position 2, then the pumps are mounted in series, that is, the suction pipe S feeds only the pump a, whose pressure

pipe goes over(see arrow 2) through the free middle valve seat into the suction conductor of the pump b and gets out of the pressure conductor of this latter into the pressure pipe D.

CLAIM:

A device for mounting in parallel and series of rotary pumps for increasing height of conveying, distinguished by this, that the suction and pressure pipes of the single pumps working automatically at small heights of conveyance on the entry of greater heights of conveyance are cut off by intermediate valves (v v^1 ? . .) in such way, that only the first pump has connection with the suction basket, the end pump with the pressure main, and that the suction pipe of each intermediate pump joins the pressure pipe of the foregoing, the pressure pipe of each intermediate the suction pipe of the following.

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